Chapter Three
FACILITY REQUIREMENTS

CHANDLER MUNICIPAL AIRPORT
AIRPORT MASTER PLAN

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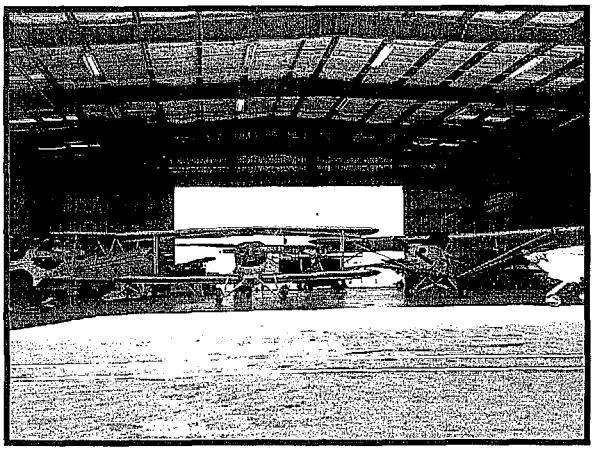
FACILITY REQUIREMENTS



To properly plan for the future of Chandler Municipal Airport, it is necessary to translate forecast aviation demand into the specific types and quantities of facilities that can adequately serve this identified demand. This chapter uses the results of the forecasts conducted in **Chapter Two**, as well as establishing planning criteria, to determine the airfield (i.e., runways, taxiways, navigational aids, marking and lighting), and landside (i.e., hangars, general aviation terminal building, aircraft parking apron, fueling, automobile parking and access) facility requirements.

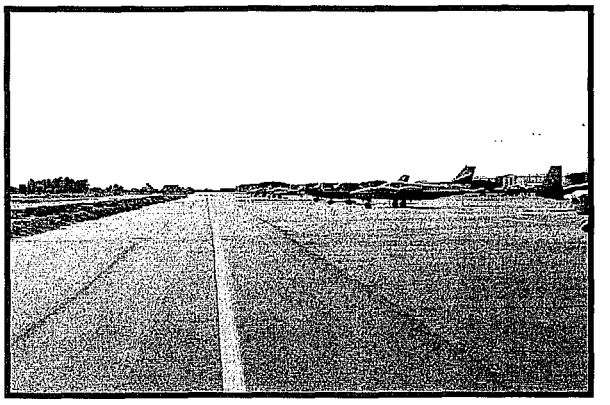
The objective of this effort is to identify, in general terms, the adequacy of the existing airport facilities, outline what new facilities may be needed, and when these may be needed to accommodate forecast demands. Having established these facility requirements, alternatives for providing these facilities will be evaluated in **Chapter Four** to determine the most cost-effective and efficient means for implementation.

AIRFIELD CAPACITY

Analysis of airfield capacity and delay was examined for this master plan utilizing FAA Advisory Circular (AC) 150/5060-5, **Airport Capacity and Delay**. The methodology presented in this advisory circular and utilized here produces statements of airfield capacity in the following major terms:

Hourly Capacity of Runways: The maximum number of aircraft operations that can take place in one hour.

Weighted Hourly Capacity: Average of hourly capacities for various runway



use scenarios weighted according to percentage of use.

Annual Service Volume: The annual capacity or a maximum level of aircraft operations that may be used as a reference in planning the runway system.

Annual Aircraft Delay: Total delay incurred by all aircraft on the airfield in one year.

The capacity of an airport is affected by several factors including airfield layout, meteorological conditions, runway use, aircraft mix, percent arrivals, percent touch-and-go's, and exit taxiway locations. These factors are described in the following paragraphs.

- **Airfield layout** refers to the location and orientation of the runways, taxiways, and terminal area. Exhibit 1B depicted the existing layout of Chandler Municipal Airport including two runways in a parallel configuration. Primary Runway 4R-22L is 4,850 feet long by 75 feet wide, while parallel Runway 4L-22R is 4,395 feet long by 75 feet wide. The runways are separated by 700 feet runway centerline to centerline. Designed primarily for general aviation operations, Runway 4R-22L is strength-rated at 30,000 pounds single gear wheel loading (SWL) while Runway 4L-22R is strength rated at 14,000 pounds SWL.

- **Meteorological conditions** analysis considers weather conditions as they affect runway utilization, orientation, and aircraft separation requirements. With the desert climate, Chandler Municipal Airport operates under VFR conditions over 98 percent of the time, while IFR conditions exist approximately two percent of the time.

- **Runway use** refers to the percentage of time each runway configuration is utilized, the number of runways, and the runway orientation. Discussions with air traffic control tower (ATCT) staff indicates that Runway 4R-22L is utilized primarily for training operations in order to keep traffic patterns on the south side of the airport. Because it is located nearer the terminal area, Runway 4L-22R is utilized for transient operations and some training operations. Approximately 60 percent of the total operations at the airport are conducted on Runway 4R-22L. The direction of take-offs and landings is often determined by the direction of the prevailing winds. Wind data collected from the area and discussion with ATCT indicate that winds are generally from the east-southeast or west-southwest, thus, Runways 4 and 22 are utilized an equal percentage of the time.

- **Aircraft mix** for the capacity analysis is defined in terms of the four aircraft classes. The aircraft mix at Chandler Municipal Airport currently includes three of the four classes. Classes A and B consist of small and medium-sized propeller aircraft and some jets, all weighing 12,500 pounds or less. These aircraft are associated primarily with general aviation activity, but do include some air taxi and commuter aircraft. The

current aircraft mix also includes a small percentage of Class C aircraft which consists of aircraft weighing between 12,500 pounds and 300,000 pounds. These aircraft include all business jets as well as larger general aviation and commuter propeller aircraft. Most business jets and propellor driven aircraft which fall into Class C weigh less than 60,000 pounds. For Chandler Municipal Airport, current and future Class C aircraft utilizing the airport will be large turbo-prop and business jet aircraft.

- **Percent arrivals** as they relate to the total operations of the airport is important in determining capacity. Under most circumstances, the lower the percentage of arrivals, the higher the hourly capacity. Except in unique circumstances, the aircraft arrival-departure split at general aviation airports is typically 50-50. At Chandler Municipal Airport, traffic information indicated no significant deviation from this pattern, and arrivals were estimated to account for 50 percent of design period operations.

- **Percent touch-and-go** analyzes the percentage of total aircraft operations that are training operations. A touch-and-go operation is normally associated with general aviation training and involves an aircraft making a landing and an immediate take-off without coming to a full stop or exiting the runway. A high percentage of touch-and-go traffic normally results in a slightly higher operational capacity. At Chandler Municipal Airport, touch-and-go operations currently account for 60 percent of annual operations. It is likely that Chandler Municipal Airport will remain primarily a training facility. Therefore, this percentage is expected to remain relatively stable in the short term, then decrease slightly over the remainder of the planning period as corporate aircraft usage increases.

- **Exit taxiways** have a significant effect on airfield capacity since their locations directly determine the occupancy time of an aircraft on the runway. Runway 4L-22R is equipped with seven exits while Runway 4R-22L is equipped with a total of five exit taxiways which can be used for aircraft operations. Given the runway configuration, the capacity analysis gives credit to exits located within a prescribed range from a runway's threshold. This range is based upon the mix index of the aircraft that use the runway. Under this criteria, the exit range for both runways is 2,000 to 4,000 feet. The exits must be at least 750 feet apart to be credited as separate exits. Runways 4R, 22L, and 22R have an exit rating of two, while Runway 4L has an exit rating of three.

CAPACITY ANALYSIS

The preceding information was used in conjunction with the airside capacity methodology developed by the FAA to determine airfield capacity for Chandler Municipal Airport.

Hourly Runway Capacity

The first step in the analysis involved the computation of the runway hourly capacity. Wind direction, the percentage of IFR and PVC weather, and the number and locations of runway exits then become important factors in determining the weighted hourly capacity.

Considering the existing runway system, the existing and forecast aircraft mix, a touch-and-go factor of 50 percent, and the taxiway exit rating of the existing runway, the hourly capacity was computed. The existing maximum hourly capacity during VFR conditions totaled 263 operations per hour, while IFR operations totaled 57 operations per hour.

The percentage of Class C aircraft is projected to increase from three to approximately eight percent for the airport over the long range planning horizon. This factor contributes to a decline in the hourly capacity of the runway system. In the long range, the maximum hourly capacity of the current runway system under VFR conditions will decline to 243 operations. The capacity of the airfield, however, will not be exceeded by design hour demand within the planning period.

The weighted hourly capacity averages the hourly capacities of the runway in VFR, IFR, and PVC conditions. At Chandler Municipal Airport, the weighted runway capacity is equal to the hourly capacity because IFR and PVC conditions occur an insignificant percentage of the time.

Annual Service Volume

Once the weighted hourly capacity is known, the annual service volume (ASV) can be determined. ASV is calculated by the following equation:

$$ASV = C \times D \times H$$

The current weighted hourly capacity (c) is 247 operations per hour. The current ratio of annual demand to average daily demand (D) was estimated to be 336. This is expected to remain constant over the long range planning period. The ratio of average daily demand to average peak hour demand (H) was estimated to be 5.5 in 1998. As operations increase, the percentage of hourly operations is expected to increase as operations will spread out throughout the day becoming less concentrated in any given hour.

The current ASV for Chandler Municipal Airport was determined to be 456,000 operations. As mentioned earlier, the percentage of Class C aircraft utilizing the airport is expected to increase to approximately eight percent. Although a higher Class C mix would result in a lower ASV, the increase in the hourly ratio contributes to a ASV increase to 512,000 operations in the long range. With operations in 1998 totaling 190,192, the airport is currently at 42 percent of its annual service volume. Long range annual operations are forecast to reach 300,000 operations which would equal 59 percent of the airport's ASV. **Table 3A** summarizes the airport's ASV over the long range planning horizon.

Annual Delay

As an airport approaches capacity, it begins to experience increasing amounts of delay to aircraft operations. Delays occur to arriving and departing aircraft during both VFR and IFR conditions. Arriving aircraft delays result in aircraft holding in the airport traffic pattern or waiting. Departing aircraft delays result in aircraft holding on the taxiway or apron until safety allows for the aircraft to depart.

As an airport's operations increase, delay increases exponentially. Because Chandler Municipal Airport is primarily utilized as a training facility and weather conditions do not play an large role in aircraft delay, annual delay at Chandler Municipal Airport is currently estimated at 634 hours. Analysis of delay factors for the long range planning horizon indicate that annual delay can be expected to reach 3,000 hours. **Table 3A** summarizes the capacity analysis conducted for Chandler Municipal Airport.

TABLE 3A
Demand/Capacity Summary
Chandler Municipal Airport

	1998	Short Term	Intermediate Term	Long Range
Annual Operations	190,192	207,000	250,000	300,000
Annual Service Volume Inputs				
Weighted Hourly Capacity	247	242	235	228
Daily Demand Ratio	336	336	336	336
Hourly Demand Ratio	5.5	5.9	6.3	6.7
Annual Service Volume	456,000	480,000	497,000	512,000
Average Delay per Operation (min)	0.2	0.3	0.4	0.6
Total Annual Delay (hours)	634	1,035	1,667	3,000

CONCLUSIONS

From the analysis, it was determined that annual operations at Chandler Municipal Airport are anticipated to reach approximately 59 percent of the airport's ASV in the long range of the planning period. FAA Order 5090.3B, **Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)**, indicates that improvements to capacity should be planned once operations reach 60 percent of the airport's ASV. If operations and aircraft mix equal levels projected for the long range, the airport will not need to make capacity improvements.

In addition to the basic capacity requirements, several other facility components must be examined to ensure that the airport is properly planned to meet the future needs. The following sections will outline the facility needs associated with future demand. That information, combined

with this capacity analysis, will provide the background for examining various alternatives to meet future aviation demands of the Chandler area.

AIRFIELD REQUIREMENTS

Airfield requirements include those facilities related to the arrival and departure of aircraft. These facilities are comprised of the following items:

- Runways
- Taxiways
- Airfield Marking and Lighting
- Navigational Aids

The selection of the appropriate FAA design standards for the development of the airfield facilities is based primarily upon the characteristics of the aircraft which are expected to use the airport. The most critical characteristics are the **approach speed** and the size of the **critical design aircraft** anticipated to use the airport now or in the future. The critical design aircraft is defined as the most demanding category of aircraft which conducts 500 or more operations per year. Planning for future aircraft use is of particular importance since design standards are used to plan separation distances between facilities. These standards must be determined now since the relocation of these facilities will likely be extremely expensive at a later date.

The Federal Aviation Administration has established criteria for use in the sizing and design of airfield facilities. These standards include criteria which relate to aircraft size and performance. According to Federal Aviation Administration Advisory Circular (AC) 150/5300-13, **Airport Design**, an aircraft's approach category is based upon 1.3 times its stall speed in landing configuration at that aircraft's maximum certificated weight. The five approach categories used in airport planning are as follows:

Category A: Speeds of less than 91 knots.

Category B: Speeds of 91 knots or more, but less than 121 knots.

Category C: Speeds of 121 knots or more, but less than 141 knots.

Category D: Speeds of 141 knots or more, but less than 166 knots.

Category E: Speeds of 166 knots or greater.

The second basic design criteria relates to aircraft size. The Airplane Design Group (**ADG**) is based upon wingspan. The six groups are as follows:

Group I: Up to but not including 49 feet.

Group II: 49 feet up to but not including 79 feet.

Group III: 79 feet up to but not including 118 feet.

Group IV: 118 feet up to but not including 171 feet.

Group V: 171 feet up to but not including 214 feet.

Group VI: 214 feet or greater.

Together, approach category and ADG identify a coding system whereby Airport design criteria are related to the operational and physical characteristics of the aircraft intended to operate at the airport. This code, the **Airport Reference Code** (ARC), has two components: the first component, depicted by a letter, is the aircraft approach category and relates to aircraft approach speed (operational characteristic); the second component, depicted by a Roman numeral, is the airplane design group and relates to aircraft wingspan (physical characteristic). Generally, aircraft approach speed applies to runways and runway-related facilities, while airplane wingspan primarily relates to separation criteria involving taxiways and taxilanes. **Exhibit 3A** graphically depicts typical aircraft within their associated ARC.

FAA advises designing all elements to meet the requirements of the airport's most demanding, or critical aircraft. As discussed above, this is the aircraft, or group of aircraft conducting 500 or more operations per year. In order to determine the airport's facility requirements, the ARC of the critical aircraft should first be determined, thus enabling the application of appropriate design criteria.

Chandler Municipal Airport is presently utilized primarily by general aviation aircraft ranging up to ARC B-II. Discussions with ATCT officials indicate that the airport is also utilized by general aviation aircraft in Categories C-I and C-II. Future aircraft mix will likely include a larger percentage of corporate aircraft falling in Category C and D, Group II.

Increased corporate aircraft utilization is typical at general aviation airports surrounded by growing population and employment centers. Once utilized only by large conglomerate type corporations, corporate aircraft (especially jets) have been increasingly utilized by a wider variety of companies. According to FAA statistics, active general aviation turbojet aircraft and hours flown by these aircraft are expected to increase on an average annual basis of 2.7 percent and 1.9 percent respectively over the next decade.

As companies shift away from downtown locations to suburban areas and smaller communities, utilization of corporate aircraft has become a cost-effective manner in which to transport executives and other personnel. The cost benefit can be attributed to the newer, fuel efficient jet aircraft which can close the expense gap between the seat on the corporate jet versus the seat on the commercial carrier. Furthermore, many businesses simply prefer the convenience provided by corporate aircraft use versus utilizing commercial air carriers at busy hub airports such as the Phoenix Sky Harbor International Airport.

Considering the sizeable industry (especially high tech) and population growth in the Chandler/Gilbert area, it is not unlikely that area airports, including Chandler Municipal Airport, will be frequented by larger corporate aircraft on the order of 500 or more operations per year within the planning period. The continued southwesterly growth of the City of Chandler, expansion of the Town of Gilbert, and development of the adjacent airport

industrial park will likely contribute to an increase in corporate aircraft activity at the airport over the planning period.

It should be noted that Williams Gateway Airport will likely serve the majority of large jet aircraft needs of the area due to the facilities and development potential available at the facility (longer runways, permanent ATCT, larger apron space, etc.). Also, if demands of the Phoenix area warrant another cargo/commercial service airport in southeastern Phoenix, Williams Gateway would be capable of accommodating this demand.

The existence or future potential of Williams Gateway, however, will not preclude the use of Chandler Municipal Airport by the full range of corporate aircraft. The development of an airport industrial/commercial airpark and growth of the population and employment bases will likely increase corporate aircraft usage at the Chandler Municipal Airport. Thus, future facility planning must include the potential for the airport to be utilized by the full range of business jets.

In the future, it is very likely that the airport will be utilized on a regular basis by a range of aircraft weighing up to 30,000 pounds. The use of the airport by aircraft weighing more than 30,000 pounds will depend upon the employer make-up in the community and/or near the airport. Most companies prefer to operate business jets versus flying on commercial aircraft because of convenience and time saving. Thus, most companies prefer to base their aircraft closer to their business location if at all possible. For planning purposes, facility planning must consider the possibility of business jets weighing over 30,000 pounds basing or utilizing the airport in the future.

In order to identify the critical aircraft which will make at least 500 annual operations, it is necessary to analyze what type of aircraft corporate operators might base at and/or utilize at Chandler Municipal Airport on a regular basis. It can be expected that the majority of corporate aircraft utilizing the airport in the future will be multi-engine piston and turbo-prop aircraft. It can also be expected that business jet usage will increase above the 500 annual operational level which is used to identify the critical aircraft. Thus, determination of the critical aircraft must consider the business jet most likely to operate at the airport more than 500 times annually.

The previous chapter indicated that eight business jets are forecasted to be based at the airport in the long range of the planning period. Thus, the combination of operations by based business jet aircraft along with transient corporate jet operations will determine the critical aircraft for the airport.

According to FAA general aviation business jet aircraft data, the Cessna and Lear series jet aircraft comprise the largest portion of active business jet aircraft. Therefore, the most demanding of these aircraft should be considered. The Lear 35 and 55 are classified as ARC D-I and C-I respectively. The series of Cessna Citation aircraft fall within ARC B-I and B-II. Because it can be expected that a mix of these aircraft will utilize the airport more than 500 times

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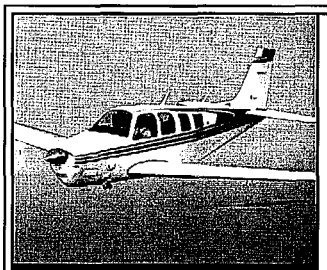


A-I

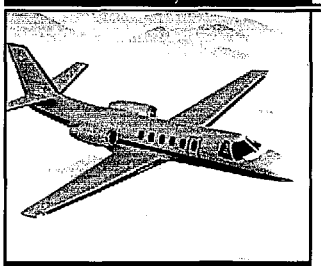
Beech Baron 55
Beech Bonanza
Cessna 150
Cessna 172
Piper Archer
Piper Seneca

B-I
less than 12,500 lbs.

Beech Baron 58
Beech King Air 100
Cessna 402
Cessna 421
Piper Navajo
Piper Cheyenne
Swearingen Metroliner
Cessna Citation I

B-II
less than 12,500 lbs.

Super King Air 200
Cessna 441
DHC Twin Otter

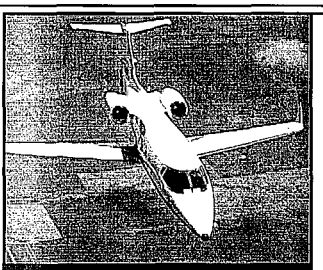


B-I, II
over 12,500 lbs.

Super King Air 300
Beech 1900
Jetstream 31
Falcon 10, 20, 50
Falcon 200, 900
Citation II, III, IV, V
Saab 340
Embraer 120

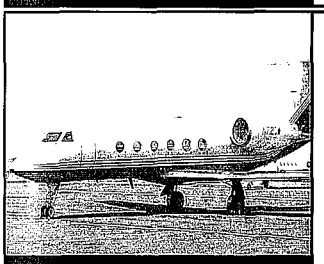
A-

DHC Dash 7
DHC Dash 8
DC-3
Convair 580
Fairchild F-27
ATR 72
ATP



C-I, D-I

Lear 25, 35, **55**
Israeli Westwind
HS 125



C-II, D-II

Gulfstream II, **III**, IV
Canadair 600
Canadair Regional Jet
Lockheed JetStar

B 727-200
B 737-200
B 737-300, 400, 500
DC-9
Fokker 70, 100
MD-80
A320

B-757
B-767
DC-8-70
DC-10
MD-11
L1011

B-747 Series
B-777

Reference Codes that will not be served at Chandler Municipal Airport

Exhibit 3A
AIRPORT REFERENCE CODES

annually, airport design standards should at a minimum conform to FAA criteria for Approach Category C and Design Group II. It should be noted, however, that larger aircraft such as the Gulfstream IV (ARC D-II) could utilize the airport 500 or more times annually. Analysis presented below will consider the runway lengths required by both C-II and D-II aircraft.

The airfield facility requirements outlined in this chapter correspond to the design standards described in FAA's Advisory Circular 150/5300-13, **Airport Design.** The following airfield facilities are outlined to describe the scope of facilities that would be necessary to accommodate the airport's role throughout the planning period.

RUNWAYS

The adequacy of the existing runway system at Chandler Municipal Airport has been analyzed from a number of perspectives, including runway orientation, airfield capacity, runway length, and pavement strength. From this information, requirements for runway improvements were determined for the airport.

Runway Orientation

The parallel runway configuration at Chandler Municipal Airport is oriented in a northeast-southwest direction. Ideally the primary runway at an airport should be oriented as close as practical in the direction of the predominant winds to maximize the runway's usage. This minimizes the percent of time that a crosswind could make the preferred runway inoperable.

FAA Advisory Circular 150/5300-13, Change 1, **Airport Design** recommends that a crosswind runway should be made available when the primary runway orientation provides less than 95 percent wind coverage for any aircraft forecast to use the airport on a regular basis. The 95 percent wind coverage is computed on the basis of the crosswind component not exceeding 10.5 knots (12 mph) for Airport Reference Codes (ARC) A-I and B-I; 13 knots (15 mph) for ARC A-II and B-II; and 16 knots (18 mph) for ARC C-I through D-II.

Wind data specific to the airport was not available, however, data for nearby Williams Gateway Airport (1976-1986) provides adequate information for this study. This data was utilized in the previous master plan and is graphically depicted on the wind rose in **Exhibit 3B**. As depicted on the exhibit, Runway orientation 4-22 provides 98.02 percent coverage for 12 mph crosswinds, 99.88 percent at 15 mph, and 99.95 percent at 18 mph. Thus, the current runway orientation provides adequate wind coverage for aircraft expected to utilize the airport and construction of a crosswind runway is unnecessary.

Runway Length

The determination of runway length requirements for the airport are based on five primary factors:

- Critical aircraft type expected to use the airport.

- Stage length of the longest nonstop trip destinations.
- Mean maximum daily temperature of the hottest month.
- Runway gradient.
- Airport elevation.

An analysis of the existing and future fleet mix indicates that business jets will be the most demanding aircraft on runway length at Chandler Municipal Airport. The typical business aircraft range from the Cessna Citation I, with minimal runway length requirements, to the Citation III and the Lear Jet models 25 and 35, requiring longer runway lengths.

Aircraft operating characteristics are affected by three primary factors. They are the mean maximum temperature of the hottest month, the airport's elevation, and the gradient of the runway. The mean maximum daily temperature of the hottest month for Chandler Municipal Airport is 103.8 degrees Fahrenheit. The airport elevation is 1,242 feet MSL. Gradient for Runway 4L-22R is 0.18 percent while gradient for Runway 4R-22L is 0.16 percent.

Table 3B outlines the runway length requirements for various classifications of aircraft that utilize Chandler Municipal Airport. These standards were derived from the **FAA Airport Design Computer Program** for recommended runway lengths. As with other design criteria, runway length requirements are based upon the critical aircraft grouping with at least 500 annual operations.

Based upon the existing aircraft fleet operating at Chandler Municipal Airport and the forecasted aircraft fleet projected through the long range planning period, Chandler Municipal Airport should be designed to accommodate, at a minimum, the Cessna Citation and Lear business jets for domestic flights within the continental United States. Currently, the length of the longest runway (Runway 4L-22R) is 4,850 feet. This length exceeds the requirements for small airplanes, but falls short of the requirements for ARC C aircraft.

According to the FAA design program, to fully accommodate 75 percent of these aircraft at 60 percent useful load (ARC C aircraft), the runway length should be 5,500 feet. Thus, in order to accommodate the critical aircraft, Runway 4L-22R should be extended 1,100 feet, or Runway 4R-22L should be extended 650 feet.

Analysis of runway length requirements should also consider the possibility of larger corporate aircraft basing or operating at Chandler Municipal Airport. The Gulfstream IV (G-IV) is an example of a large, D-II aircraft which could utilize the airport 500 times annually. According to FAA statistics, there are currently 203 G-IV aircraft operating in the U.S. In fact, one G-IV aircraft is owned by the Dial Corporation which has offices in Scottsdale. If a company which owns a G-IV aircraft locates to the Chandler area, or if a company owning a G-IV aircraft conducts business in the Chandler area, it is possible that the G-IV could operate at the airport 500 times annually. Thus, runway length requirements should consider this aircraft.

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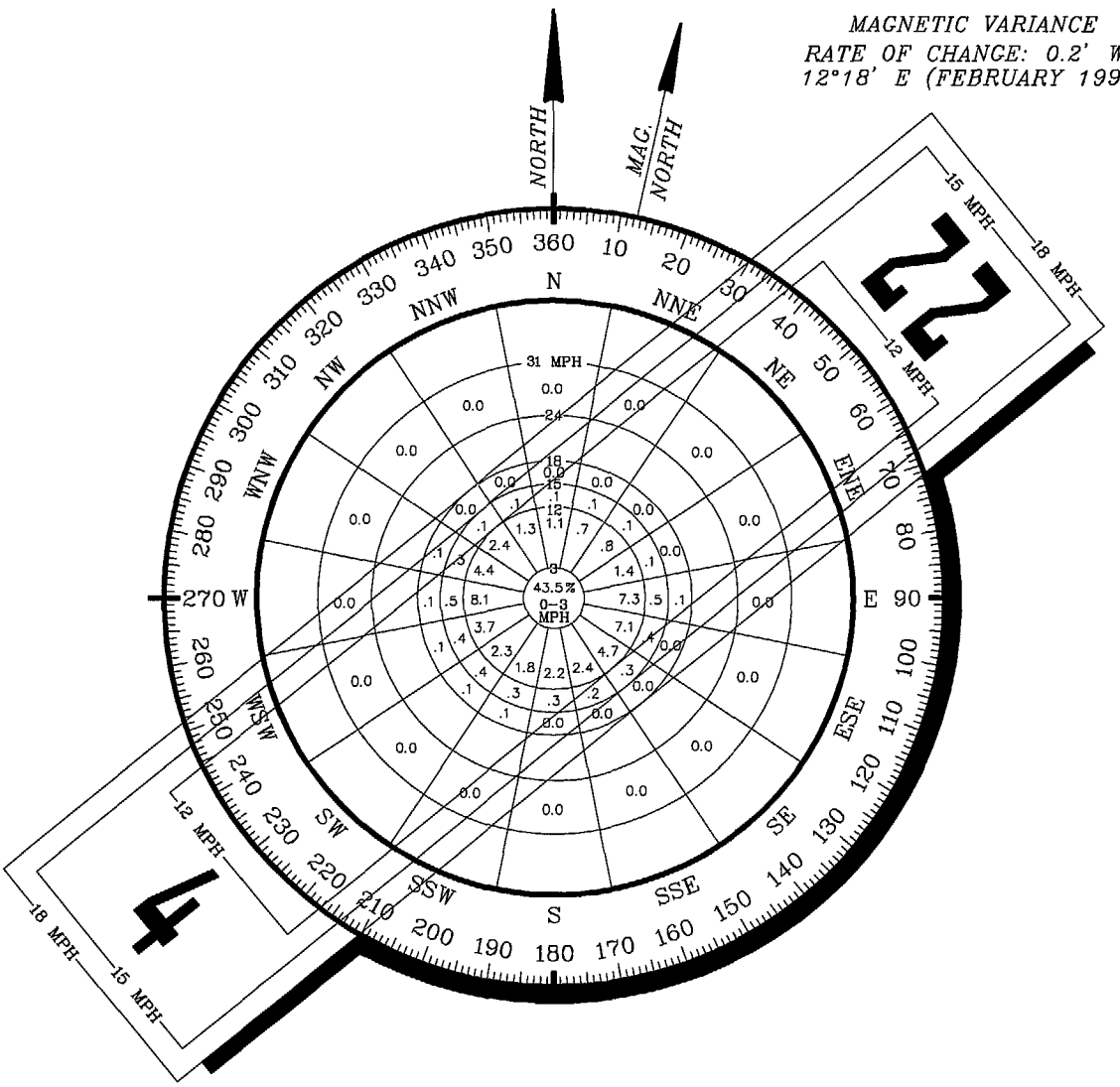


WIND COVERAGE

	12 MPH (14 KNOTS)	15 MPH (17 KNOTS)	18 MPH (20 KNOTS)
Runways 4–22	*98.02%*	*99.88%*	*99.95%*

SOURCE:
USAFETAC
Air Weather Service (MAC)
DATA STATION:
Williams Air Force Base
Mesa, Arizona
OBSERVATIONS:
53,403 Observations
1976–1986

Exhibit 3B
WINDROSE

According to **Table 3B**, a runway measuring 6,800 feet would be needed to accommodate the G-IV aircraft (100 percent of business jets at 60 percent useful load). This would require a 1,950 foot extension to Runway 4R-22L, or a 2,400 foot extension to Runway 4L-22R. Alternative analysis conducted in the next chapter will further refine runway lengths needed to accommodate aircraft for the planning period.

TABLE 3B
Runway Length Requirements
Chandler Municipal Airport

AIRPORT AND RUNWAY DATA	
Airport elevation	1,042 feet
Mean daily maximum temperature of the hottest month	103.8 F
Maximum difference in runway centerline elevation	8 feet
RUNWAY LENGTHS RECOMMENDED FOR AIRPORT DESIGN	
Small airplanes with less than 10 passenger seats	
75 percent of these small airplanes	3,100 feet
95 percent of these small airplanes	3,700 feet
100 percent of these small airplanes	4,300 feet
Small airplanes with 10 or more passengers seats	4,800 feet
Large airplanes of 60,000 pounds or less	
75 percent of business jets at 60 percent useful load	5,500 feet
100 percent of business jets at 60 percent useful load	6,800 feet

REFERENCE: FAA's airport design computer software utilizing Chapter Two of AC 150/5325-4A, **Runway Length Requirements for Airport Design**, no Changes included.

Runway Width

Both runways at the airport are currently 75 feet wide. This width is adequate for aircraft in Approach Categories A and B. However, FAA design standards call for a 100-foot width for Approach Category C and D. Therefore, any runway that will serve Category C or D aircraft on a regular basis should be widened to 100 feet. Alternative analysis conducted in the next chapter will determine which runway should be widened to 100 feet.

Runway Strength

As previously mentioned, Runway 4L-22R has a pavement strength of 14,000 pounds SWL while Runway 4L-22R is strength rated at 30,000 pounds SWL. This is adequate for aircraft that currently use the airport on a regular basis. For example, the Cessna Citation VI can weigh up to 22,000 pounds on dual wheel gear loading (DWL).

As mentioned earlier, the airport could potentially be served by larger business jets such as the G-IV. Aircraft such as the G-IV would need a pavement strength of 60,000 pounds DWL. Alternative analysis conducted in the next chapter will further refine the pavement strength needs for the runways over the long range planning period.

TAXIWAYS

Taxiways are constructed primarily to facilitate aircraft movements to and from the runway system. Some taxiways are necessary simply to provide access between the aprons and runways, whereas other taxiways become necessary as activity increases at an airport to provide safe and efficient use of the airfield.

Both runways at the airport are served by a full length parallel taxiway. Runway 4L-22R, however, has only a partial parallel taxiway on the north side of the runway providing access to the current terminal area. The runway is served by a full length parallel taxiway on the south side of the runway which was constructed to serve future development on the south side of the airport.

In order to maximize operational efficiency, the partial parallel taxiway serving the north side of Runway 4L-22R should be extended the full length of the runway. Runway 4L-22R is served by seven exit taxiways while Runway 4R-22L is served by five exit taxiways. If the runway is extended, an additional exit taxiway will be required at the extended end. For airfield efficiency, an additional midfield exit should also be considered on Runway 4R-22L.

The width of all existing taxiways is 40 feet. This will be adequate for the aircraft that are anticipated to operate at Chandler Municipal Airport over the long range. All planned taxiways should be a minimum of 35 feet wide in order to accommodate aircraft anticipated to utilize the airport in the future.

NAVIGATIONAL AIDS AND LIGHTING

Airport and runway navigational aids are based on FAA recommendations as depicted in DOT/FAA Handbook 7031.2B, **Airway Planning Standard Number One** and FAA Advisory Circular 150/5300-2D, **Airport Design Standards, Site Requirements for Terminal Navigation Facilities.**

Navigational aids provide two primary services to airport operations, precision guidance to specific runway and/or non-precision guidance to a runway or the airport itself. The basic difference between a precision and non-precision navigational aid is that the former provides electronic descent, alignment (course), and position guidance, while the non-precision navigational aid provides only alignment and position location information. The necessity of such equipment is usually determined by design standards predicated on safety considerations and operational needs. The type, purpose and volume of aviation activity expected at the airport are factors in the determination of the airport's eligibility for navigational aids.

Global Positional System

The advancement of technology has been one of the most important factors in the growth of the aviation industry in the twentieth century. Much of the civil aviation and aerospace technology has been derived and enhanced from the initial development of technological improvements for military purposes. The use of orbiting satellites to confirm an aircraft's location is the latest military development to be made available to the civil aviation community.

Global positioning systems (GPS) use two or more satellites to derive an aircraft's location by a triangulation method. The accuracy of these systems has been remarkable, with initial degrees of error of only a few meters. As the technology improves, it is anticipated that GPS may be able to provide accurate enough position information to allow Category II and III precision instrument approaches, independent of any existing ground-based navigational facilities. In addition to the navigational benefits, it has been estimated that GPS equipment will be much less costly than existing precision instrument landing systems.

Currently, Chandler Municipal Airport is served by an NDB approach to Runway 4R and VOR/GPS approach to Runway 4L. The VOR/GPS approach provides the best weather minimums allowing the airport to remain operational with reported cloud ceilings of at least 400 feet and one mile visibility. With the evolution of GPS, however, it is likely that Chandler Municipal Airport will have the opportunity to be served by a GPS instrument approach in the future which would allow the airport to remain operational with Category I (CAT I) weather minimums. Therefore, the airport should be planned for GPS approaches.

Because the cost of implementing a CAT I GPS approach is much lower than traditional instrument landing system (ILS) equipment, at least one end of the runway system should be planned for a CAT I approach. A CAT I approach will allow the runway to remain operational with visibility of one-half mile and cloud ceilings of at least 200 feet. The main consideration in implementing a CAT I approach is the required separation and obstruction clearances. A cleared 50 to 1 approach slope is desired, however, a cleared 34 to 1 approach slope can accommodate a CAT I approach. The next chapter will further discuss separation and obstruction clearance criteria and analyze which runway end should be planned for a CAT I GPS approach.

Airport Visual Approach Aids

Visual glide slope indicators (VGSI) are a system of lights located at the side of the runway which provide visual descent guidance information during an approach to the runway. Both ends of the runway are currently equipped with VGSI systems at Chandler Municipal Airport. Runway 4R-22L is equipped with a four box precision approach path indicator (PAPI-4) while Runway 4L-22R is equipped with a two-box visual approach path indicators (VASI-2). While two-box systems are adequate for use by propeller aircraft, four-box systems are recommended for use by business jet aircraft. Therefore, the

primary runway should be served by a four box system.

Airfield Lighting and Marking

Runway identification lighting provides the pilot with a rapid and positive identification of the runway end. The most basic system involves runway end identifier lights (REIL's). REIL's should be considered for all lighted runways not planned for a more sophisticated approach light system (ALS). Currently, both ends of Runway 4R-22L are equipped with REIL's, while Runway 4L-22R should be planned for REIL's in the future.

An approach light system should be planned for at least one runway end in order to establish CAT I minimums for the planned GPS approach. A medium intensity approach light system with runway alignment indicator lights (MALSR) is required for a GPS approach to attain the visibility minimums to one-half mile. If obstructions and/or clearances surrounding the airport dictate that the runway can only be served by a GPS approach with three quarters of a mile visibility, an omni-directional approach lighting system (ODALS) would be required.

The medium intensity runway lighting (MIRL) and medium intensity taxiway lighting (MITL) currently serving both runways and taxiways areas will be adequate for the planning period. The runway ultimately served by a GPS precision approach should be upgraded to precision marking while the other runways should be marked with nonprecision marking.

The airport also presently has a wind cone and segmented circle which provides pilots with information about wind conditions. In addition, an airport beacon assists in identifying the airport from the air at night. Each of the facilities should be maintained in the future.

LANDSIDE REQUIREMENTS

Landside facilities are those necessary for handling of aircraft, passengers, and cargo while on the ground. These facilities provide the essential interface between the air and ground transportation modes. These areas will be subdivided into two parts: general aviation facilities, and support facilities. The capacities of the various components of each area were examined in relation to projected demand to identify future landside facility needs.

GENERAL AVIATION FACILITIES

The purpose of this section is to determine the space requirements during the planning period for the following types of facilities normally associated with general aviation terminal areas:

- Hangars
- Aircraft Parking Apron
- General Aviation Terminal

Hangars

The space required for hangar facilities is dependent upon the number and type of aircraft expected to be based at the

airport. Based upon an analysis of general aviation facilities and the current demand at Chandler Municipal Airport, percentages representing hangar requirements for various types of general aviation aircraft have been calculated. The analysis indicates approximately 60 percent of based aircraft at the airport are hangared while the remaining aircraft remain tied down on the apron area or in shaded tie-downs.

Weather conditions at Chandler Municipal Airport, including blowing dust and extreme heat in the summer as well as an active three year hangar waiting list, suggests most based aircraft owners prefer hangar space to outside tie-downs. Since this is their preference, it is necessary to determine what percentages of these aircraft would utilize conventional-type and shade tie-down hangars as opposed to individual T-hangars. T-hangars are relatively inexpensive to construct and provide the aircraft owner more privacy and greater ease in obtaining access to the aircraft. The principal uses of conventional hangars at general aviation airports are for large aircraft storage, storage during maintenance, and for housing fixed base operator activities.

From the analysis in **Table 3C**, it appears that conventional hangar storage space is currently needed. Also, additional conventional hangers are needed in the intermediate term and long range as an increase of larger and more sophisticated aircraft base at the airport. Also, as existing conventional hangars age, they may need to be replaced. Furthermore, the airport should always have space available to accommodate corporate hangars as an attraction for new businesses considering relocation to the Chandler/Gilbert area.

Presently, all of the T-hangar positions on the airfield are occupied and there is a waiting list to obtain space. Also, the City of Chandler is currently requesting proposals from firms interested in constructing, maintaining, and leasing additional T-hangar units.

The airport provides 12 nested T-hangar storage facilities. Analysis of the T-hangar facilities indicates that ten of these T-hangar facilities (each providing 10 nested individual units) provide an area of 1,280 square feet per individual storage unit, while two T-hangar facilities (providing 8 nested individual units) provide an area of 2,000 square feet of space per individual storage unit. Total T-hangar space available at the airport totals 160,000 square feet of storage space. Analysis of future T-hangar requirements, as depicted on **Table 3C**, indicates that an additional 124 T-hangars will be needed within the long range planning horizon.

Currently, there are two shaded tie-down facilities at the airport providing 20 individual spaces. Shaded tie-down facilities are typical at airports located in warm climates with little annual precipitation and a high amount of sun days. These units are typically less expensive to lease and are preferred by aircraft owners not concerned with enclosing their aircraft, but still wanting protection from sun. Thus, future requirements must account for these desires.

TABLE 3C
Hangar Requirements
Chandler Municipal Airport

	Currently Available	Current Need	Short Term	Intermediate Term	Long Range
Based Aircraft					
Single Engine		233	267	304	380
Multi-Engine		15	19	22	30
Turboprops		1	4	8	15
Jets		0	1	4	8
Rotorcraft		5	9	12	17
Total		254	300	350	450
Aircraft to be Hangared					
Single Engine		151	174	198	240
Multi-Engine		13	16	19	26
Turboprops		1	4	8	15
Jets		0	1	4	8
Rotorcraft		3	6	8	12
Total		168	201	237	301
T-Hangar Positions	116	148	170	195	240
Shade Hanger Positions	20	8	10	11	13
Conventional Hangar Positions	10	12	21	31	58
Conventional Hangar Area (s.f.)					
Aircraft Storage	9,000	15,200	31,000	52,900	88,800
Aircraft Maintenance	20,100	23,000	27,800	33,600	43,700
Total	29,100	38,200	58,800	86,500	132,500
T-Hangar Area (s.f.)	160,000	207,200	238,000	273,000	336,000
Shade Hangar Area (s.f.)	25,920	7,200	9,000	9,900	11,700
Total Hangar Area (s.f.)	215,020	252,600	305,800	369,400	480,200

Current utilization indicates that one shaded facility provides 2,040 square feet per storage unit while another facility provides 800 square feet per unit. A planning standard of 900 square feet per unit was utilized in determining future shade hangar facilities.

As indicated by **Table 3C**, the existing shade hangar facilities should be adequate for shade hangar requirements by the end of the planning period. This can be attributed to aircraft owner preferences for T-hangars if available.

The final step in the process of determining hangar requirements involves estimating the area necessary to accommodate the required hangar space. Typically, T-hangar facilities provide 1,200 square feet of space per individual storage unit. For Chandler

Municipal Airport, however, some aircraft owners prefer the existing larger T-hangar's. Thus, for planning purposes, an average of 1,400 square feet per based aircraft stored in T-hangars was used to determine future storage space requirements.

A planning standard of 1,000 square feet for piston and 2,500 square feet for turbine aircraft was then applied to the aircraft to be hangared in conventional hangars. Shade hangar space requirements considered 900 square feet per aircraft. Also, an area equal to 10 percent of the total hangar space on the airport should be allocated for maintenance shop facilities. It is assumed that this maintenance area would be housed in conventional hangar space.

Aircraft Parking Apron

A parking apron should be provided for at least the number of locally-based aircraft that are not stored in hangars, as well as transient aircraft.

Currently, the airport maintains 122 aircraft tie-down positions on 90,500 square yards of apron space. The apron provides area for fueling, taxiing, and aircraft tie-down. At the present time, approximately 112 based aircraft are stored full-time on the ramp, although some aircraft stored in conventional hangars may be moved to the ramp during the day to provide hangar area for aircraft maintenance. In the future, based aircraft are expected to continue to be stored in hangars.

FAA Advisory Circular 150/5300-13 suggests a methodology by which transient apron requirements can be determined from knowledge of busy-day operations. At Chandler Municipal Airport, the number of itinerant spaces required was determined to be approximately 17.5 percent of the busy-day itinerant operations.

A planning criterion of 700 square yards per aircraft was applied to the number of itinerant spaces to determine future transient apron requirements. For based aircraft, apron space requirements is 500 square yards per aircraft. The results of this analysis are presented in **Table 3D.** As evident from the analysis, 109 additional aircraft spaces and approximately 41,400 square yards of pavement will be required as additional aircraft base at the airport and itinerant aircraft use of the airport increases.

General Aviation Terminal Facilities

General aviation terminal facilities have several functions. Space is required for passenger waiting, pilot's lounge and flight planning, concessions, management, storage and various other needs. This space is not necessarily limited to a single, separate terminal building but also includes the space offered by fixed base operators for these functions and services.

The existing general aviation terminal building is located on the northwestern portion of the ramp providing 5,500 square feet of space. The FBO's, specialty operators, and restaurant provide approximately 10,000 square feet of space.

TABLE 3D
Aircraft Parking Apron Requirements
Chandler Municipal Airport

	Current Need	Short Term	Intermediate Term	Long Range
Locally Based Aircraft Apron				
Based Aircraft Positions	86	99	113	149
Apron Area (s.y.)	43,000	49,500	56,500	74,500
Itinerant Ramp Requirements				
Busy Day Itinerant Operations	296	311	392	468
Itinerant Aircraft Positions	52	54	69	82
Apron Area (s.y.)	36,400	37,800	48,300	57,400
Total Positions	138	153	182	231
Total Apron Area (s.y.)	79,400	87,300	104,800	131,900

The methodology used in estimating general aviation terminal facility needs was based upon the number of airport users expected to utilize general aviation facilities during the design hour as well as FAA guidelines. A planning average of 1.8 passengers per flight increasing to 2.5 passengers per flight by the end of the planning period was multiplied by the number of design hour itinerant operations to determine design hour itinerant passengers.

Space requirements were then based upon providing 90 square feet per design hour itinerant passenger. **Table 3E** outlines the general space requirements for general aviation terminal services at Chandler Municipal Airport through the planning period. Analysis of future general aviation terminal area space requirements presented in **Table 3E** indicates that current general aviation terminal building space will be adequate for the remainder of the planning period. However, it should be noted that the FBO and specialty operators have duplication of space because of similar services provided. Thus, the terminal building may need to be expanded in the future to accommodate future transient demand which may not utilize FBO space.

AVIATION SUPPORT FACILITIES

Various facilities that do not logically fall within classifications of airfield, terminal building, or general aviation facilities have been identified for inclusion in this Master Plan. Facility requirements have been identified for these remaining facilities:

- Air Traffic Control Tower
- Airport Access and Vehicle Parking
- Fuel Storage

AIR TRAFFIC CONTROL TOWER (ATCT)

As previously mentioned, Chandler Municipal Airport is served by an air

traffic control tower (ATCT) which began operating at the airport in June of 1995. The ATCT is operated by Barton ATC International, Inc. through a contract agreement with the FAA. The establishment of a temporary tower was mandated by the U.S. congress for a trial period of June 95 to June of 97 in order to determine if the construction of a permanent tower was required. In 1998, a permanent location for the location of an ATCT was identified under another study. The ATCT has been constructed and is now operational.

TABLE 3E
General Aviation Terminal Area
Chandler Municipal Airport

	Currently Available	Current Need	Short Term	Intermediate Term	Long Range
Design Hour Itinerant Passengers		82	95	135	180
General Aviation Terminal Space (s.f.)	10,000	7,377	8,550	12,150	16,200

AIRPORT ACCESS AND VEHICLE PARKING

Access to Chandler Municipal Airport is available from Germann Road to the north, and Queen Creek Road to the south via Airport Boulevard. Germann Road is currently being improved and will be adequate to serve airport needs in the future.

Queen Creek Road is a two-lane roadway running east-west south of the airport. It is unlikely that automobile traffic generated by demand at the airport will drive the need for Queen Creek to be widened. However, as residential and commercial/industrial development nears the airport and airport activity increases, Queen Creek will most likely need to be widened to four lanes.

On-airport access is provided by Airport Boulevard, Stinson Way, and Ryan Road (which leads directly to the terminal building). These roadways are two-lanes and should be adequate with proper maintenance.

As mentioned in Chapter One, a proposed four-lane freeway (SANTAN Freeway) will run east-west approximately one mile north of the airport. It is planned that the freeway will have interchange access at McQueen, Cooper, and Gilbert Roads. The freeway will aid airport traffic by providing a high speed roadway near the airport for transient passengers needing regional access to the north.

Vehicle parking demands have been determined for Chandler Municipal Airport. Space determinations were

based on an evaluation of the existing airport use as well as industry standards. General aviation spaces were calculated by multiplying design hour itinerant passengers by the industry standard of 1.8.

Currently, approximately 60 individuals are employed on a part-time and/or full-time basis at the airport. Employee parking spaces typically equals 10 percent of total parking spaces on the airport.

Total parking area was calculated by multiplying the total parking spaces by 315 square feet. Parking requirements are summarized in **Table 3F**.

Currently, parking spaces/areas are available near the new and old terminal buildings and adjacent FBO and specialty operators on the airport. Approximately 245 automobile parking spaces providing approximately 75,000 square feet of space are available on the airport. Currently, approximately 135 spaces are provided by the parking lot adjacent the old terminal building. The new terminal building provides only 30 spaces. Thus, the analysis of parking space requirements may indicate adequate space for the planning period, however, individual areas on the airport could be undersized to meet future parking demands. As new facilities are constructed, new parking facilities should be built to adequately accommodate demand.

TABLE 3F
General Aviation Automobile Parking Requirements
Chandler Municipal Airport

	Currently Available	Short Term	Intermediate Term	Long Range
Total Parking Spaces	245	170	240	325
Auto Parking Area (s.f.)	75,000	53,550	75,600	102,375

FUEL STORAGE

The City of Chandler owns four fuel tanks located underground, adjacent to the heliport. Included in the fuel farm is a 10,000 gallon tank storing 80/87 octane fuel, two 8,000 gallon steel tanks storing 100LL, and one fiberglass 12,000 gallon tank leased to Venture Aviation for storage of 100LL Avgas. The City also operates a self-service fuel island located on the apron west of the terminal building. The fuel farm meets EPA/ADEQ environmental standards.

As previously mentioned, Chandler Air Service has constructed an above ground 12,000 gallon fuel storage tank which is utilized for storing 100LL Avgas. The FBO also sells jet fuel which is stored in a 2,200 gallon capacity fuel truck.

Future fuel storage requirements analysis considered historical fuel sales at the airport. Until August of 1994, the City of Chandler conducted all fuel sales at the airport. After August 1994, the City allowed the FBO's the

opportunity to retail fuel at the airport via fuel truck while maintaining only a fuel farm for its fuel sales.

According to fuel sales records, total fuel sold at the airport was 315,758 gallons in 1996. A sales high was recorded in FY 1991/1992 of 347,432 gallons.

Fuel storage requirements are typically based upon maintaining a one month supply of fuel during an average month, however, more frequent deliveries can reduce the fuel storage capacity requirement. For 1996, monthly fuel sales averaged 1,193 gallons of 80/87 octane, 22,999 gallons of 100LL, and 2,122 gallons of Jet A. With 156,209 annual operations, the average rate of fuel consumption for 1996 was 2.2 gallons per operation.

The airport is currently utilized primarily by aircraft requiring 100LL fuel. Because an increasing percentage of future aircraft utilizing the airport will require Jet A fuel, future fuel storage requirements must consider the specific requirements of 100LL and Jet A fuel separately.

Approximately 92.5 percent of annual operations in 1996 were conducted by aircraft requiring 100LL fuel, which would equate to 144,493 operations. In 1996, 275,982 gallons of 100LL fuel was sold. Therefore, 1.9 gallons of 100LL fuel was sold per operation. For planning purposes, future storage requirements of 100LL fuel utilized a constant amount of 2.0 gallons per operation. **Table 3G** presents future fuel storage requirements for the airport.

TABLE 3G
Fuel Storage Requirements
Chandler Municipal Airport

	1998	Short Term	Intermediate Term	Long Range
Annual Operations	191,121	190,000	250,000	300,000
Average Month Operations	15,930	15,850	19,175	25,000
Monthly Operations Requiring				
80/87 Octane	630	600	525	4,500
100LL	12,500	15,750	19,065	22,650
Jet A	600	900	1,250	2,000
Operations Per Gallon Ratio				
80/87 Octane	2.0	2.0	2.0	2.0
100LL	1.9	2.0	2.0	2.0
Jet A	5.4	5.5	5.7	6.0
Monthly Storage Requirements				
80/87 Octane	1,260	1,200	1,100	9,000
100LL	27,930	31,500	38,100	45,300
Jet A	3,240	4,900	7,100	12,000

Currently, approximately three percent of aircraft operating at the airport require Jet A fuel. This would equate to 4,686 annual operations by these aircraft. In 1996, 25,463 gallons of Jet A fuel was sold. Thus, 5.4 gallons of Jet A fuel was sold per turbine operation.

Forecasts conducted in the previous chapter indicate that operations by turbine aircraft will increase to approximately eight percent over the long range planning horizon. As operations by turbine aircraft increase and more turbine aircraft base at the airport, this figure can be expected to increase. For planning purposes, the gallons per operation ratio for Jet A was increased to 6.0 for the long range planning horizon.

Consideration was given to the future storage requirements of 80/87 octane fuel. Because this fuel is utilized only by older, and smaller aircraft it was determined that the current 10,000 gallon storage tank would be adequate for the long range planning horizon.

SUMMARY

The intent of this chapter has been to outline the facilities required to meet potential aviation demands projected for Chandler Municipal Airport for the planning horizon. A summary of the airfield and general aviation facility requirements is presented on **Exhibits 3C** and **3D**.

Following the facility requirements determination, the next step is to develop a direction for development which best meets these projected needs. The remainder of the master plan will be devoted to outlining this direction, its schedule, and its costs.

96MP07-3C-3/5/97

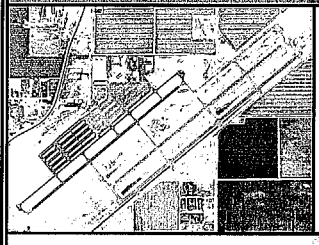
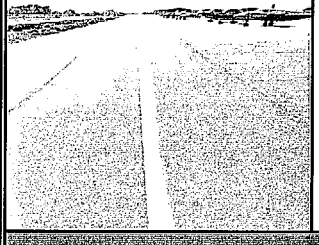
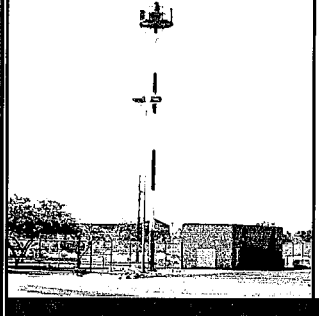
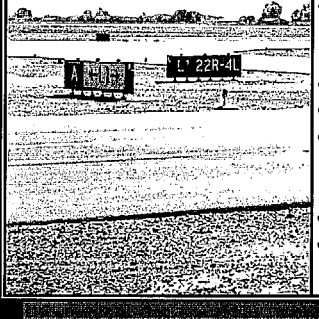
	EXISTING	SHORT TERM	INTERMEDIATE TERM	LONG RANGE
RUNWAYS				
	**RUNWAY 4R-22L** • 4,850' X 75' • 30,000 lbs. SWL **RUNWAY 4L-22R** • 4,395' X 75' • 14,000 lbs. SWL	**RUNWAY 4R-22L** Same **RUNWAY 4L-22R** Same	**PRIMARY RUNWAY** • 5,500' X 100' **PARALLEL RUNWAY** • 4,300' X 75'	**PRIMARY RUNWAY** • 6,800' X 100' **PARALLEL RUNWAY** • 4,300' X 75'
TAXIWAYS				
	**RUNWAY 4R-22L** • Full length parallel south side 40' wide • Partial Parallel north side 40' wide • Five exits **RUNWAY 4L-22R** • Full length parallel • 40' wide • Seven exits	**RUNWAY 4R-22L** Same **RUNWAY 4L-22R** Same	**PRIMARY RUNWAY** • Full length parallel • Six exits • 40' wide **PARALLEL RUNWAY** • Full length parallel • Five exits • 40' wide	**PRIMARY RUNWAY** • Full length parallel • Seven exits • 40' wide **PARALLEL RUNWAY** Same
NAVIGATIONAL AIDS				
	• ATCT **RUNWAY 4R-22L** • PAPI-4 • NDB (4R) **RUNWAY 4L-22R** • VASI-2 • VOR (4L) • GPS (4L)	Same **RUNWAY 4R-22L** Same **RUNWAY 4L-22R** Same	Same **PRIMARY RUNWAY** • GPS (CAT I) • VGSI-4 **PARALLEL RUNWAY** • GPS • VGSI-2	Same **PRIMARY RUNWAY** Same **PARALLEL RUNWAY** Same
LIGHTING AND MARKING				
	• Wind Cone, Segmented Circle • Airport Beacon • MITL **RUNWAY 4R-22L** • MIRL • REIL • Non-precision Marking **RUNWAY 4L-22R** • MIRL • Basic Marking	Same **RUNWAY 4R-22L** Same **RUNWAY 4L-22R** Same	Same **PRIMARY RUNWAY** • MIRL • MALSR • Precision Marking **PARALLEL RUNWAY** • MIRL • REIL • Non-precision Marking	Same **PRIMARY RUNWAY** Same **PARALLEL RUNWAY** Same

Exhibit 3C
AIRFIELD REQUIREMENTS

96MP07-3D-9/8/99

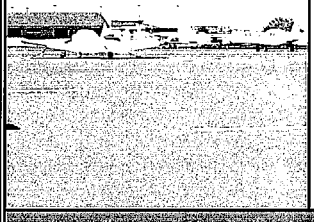
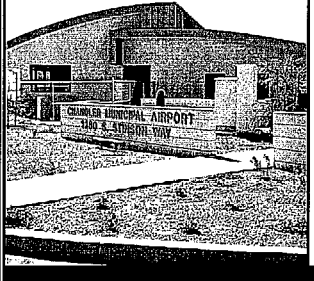
	AVAILABLE	CURRENT	SHORT TERM	INTERMEDIATE TERM	LONG RANGE
HANGARS					
	**Aircraft Positions**				
	Conventional Hangars ±10	12	21	31	58
	T-Hangars 116	148	170	195	240
	Shade Hangars 20	8	10	11	13
APRON TIE DOWN					
	Aircraft Positions 122	138	153	182	231
	Area (sq. yds.) 90,500	79,400	87,300	104,800	131,900
GENERAL AVIATION TERMINAL					
	Gross Area (sq. ft.) ±10,000	7,377	8,550	12,150	16,200
AUTO PARKING					
	Spaces 245	120	170	240	325
	Area (sq. ft.) 75,000	37,800	53,550	75,600	102,375

Exhibit 3D
LANDSIDE REQUIREMENTS